LP4820 Bare warp pairs of yarns same debit different tensions

# PATENT SPECIFICATION

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## (54) WOVEN FABRICS AND PROCESS FOR MANUFACTURING SUCH FABRICS

(71) We, TEINTURERIES DE LA TURDINE, a French Body Corporate of 5 Route de Paris, 69170 Tarare, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a process for making a stretchable woven fabric and to a fabric so made.

For some considerable time it has been known to manufacture elastic woven fabrics using highly extensible elastomeric yarns, especially of polyurethane.

In the description which follows, the term "highly extensible elastomeric yarns" means yarns which can be used in weaving, with the capability of reversible elongation of 300% and more and of high elastic recovery. This expression is in particular applied to yarns based on elasthane, polyurethane or elastodiene. The term "elastic yarn" means a yarn which can be used in weaving, having a substantial capability of elongation, of 100% to 250%, and recovery power.

In order to manufacture such woven elastic fabrics it has been proposed to use, in the warp and/or weft, sheathed or composite yarns comprising a core of elastomeric yarn covered by any kind of textile material such as a yarn spun from fibres or an elastic textured yarn. The composite yarns are given a suitable thermal treatment, sometimes called "thermal shock", with a view to temporarily reducing or eliminating their extensibility. Such thermal treatment renders the yarns suitable for weaving or knitting, after which the extensibility of the fabric is re-established in a conventional manner in the finished material. Although this technique is very widespread, it nevertheless has the notable drawbacks of being expensive, and of providing fabrics which are often blistered and uneven as a result of movement of the yarns in the fabric, and sliding of yarns upon one another at the warp and weft crossing points during the re-establishment of extensibility. This leads to the necessity of providing a further thermal treatment so as to render the fabric flat, so that it can be made up. This can cause degrading and hardening of the elastomeric yarn, and thus the fabric. Finally, such a technique gives fabrics an elasticity of which, though great, is far from that which could be expected from the constituents.

It has also been proposed to weave bare elastomeric yarns, especially of polyurethane and elasthane, that is to say without any covering such as sheathing. Thus, it has been suggested to weave a fabric having a warp obtained by providing, in alternate dents in the reed, a tensioned, bare, elastomeric yarn and a secondary yarn which is, for example, an elastic textured yarn such as a tensioned crimped yarn.

This technique, however, has not been well developed, partly because weaving the bare elastomeric yarn in conventional looms has proved difficult, if not impossible, as a result of the yarns being worn away by the shuttle and partly because it results in creped fabrics which have to be subjected to a thermal treatment under tension so as to render them flat and suitable for making up. This thermal treatment is costly, and again causes a degradation of the elastomeric yarn which is reflected in a reduction of mechanical performance of the fabric and in an appreciable reduction of the elasticity. Moreover, during the thermal treatment the secondary yarn may be irregularly affected, causing the creped appearance resulting from irregular contraction of that yarn between two weft yarns. Despite subsequent treatments this irregular contraction will persist.

According to the present invention there is provided a method of weaving an elastic fabric wherein there are employed, in the warp, pairs of yarns, each pair comprising a bare elastomeric yarn and another,

secondary yarn, the two yarns of each pair being under different tensions when woven and passing in parallel through the same heald eyelet to the same dent in the reed.

The invention also provides an elastic fabric made by that method.

It is found that the contraction or compression of the secondary yarns after weaving is substantially constant throughout the fabric and that the fabric is therefore relatively flat, that is it is largely free from creping and unevenness.

The bare elastomeric yarn is advantageously a polyurethane or elastodiene yarn for instance Lycra, Rhodastic, Glospan, Spandex, Dorlastan, (Registered Trade Marks).

The secondary yarn may be a spun yarn or a multi-filamentary yarn.

Advantageously the said secondary yarn is an elastic yarn as defined above, bulked or textured. Excellent results are obtained with a yarn textured by the false twist method. For certain applications this yarn may also be a spun fibre yarn, especially a "high" bulked yarn, indeed a cotton yarn is possible.

Preferably, the tensions applied to the bare elastomeric yarn and to the secondary yarn are as great as possible while being compatible with the weaving operation and without, of course, causing breakage of these yarns. In practice the elastomeric yarn may be stretched by at least 80% of its elongation to rupture.

There may be used as the weft yarn any natural or synthetic textile yarn in one of many forms for instance multi-filamentary yarns, folded yarns or composite yarns can be used. The weft yarn may be an elastic (as above defined) yarn (e.g. a crimped textured yarn). If it is desired to produce fabrics of square elasticity i.e. substantially equal elasticity in the warp as in the weft direction, highly extensible elastomeric yarns such as a polyurethane or elasthane yarn, which may be combined with or sheathed by a false twist crimped yarn can be used in the weft. The count of the yarns ends per unit length is advantageously substantially the same in the warp as in the weft direction.

For other applications the weft yarn may be a spun fibre yarn, especially of cotton.

The weave of the fabric may be of any type e.g. satin or plain. If desired, dyed in the yarn fabrics may be obtained so as to produce fabrics with longitudinal bands of colours or tartans for instance.

The warp can be provided by directly running from a creel an alternation of the tensioned, bare, elastomeric yarn and the tensioned secondary yarn, the yarns being in pairs in which they are parallel and passing through the same heald eyelet and the same dent in the reed. This arrangement is suitable for obtaining narrow fabrics such as woven ribbons.

Alternatively two beams can be located on the loom. One beam carries a sheet of bare elastomeric yarns, the other beam carries a sheet of parallel secondary yarns. The tension of the secondary yarns can be ensured by a conventional means such as a set of weights bearing on the shaft of the beam so as to brake it, and the tension of the sheet of bare elastomeric yarns can be ensured by a let-off motion driven in synchronism with the take-up motion of the loom, the ratio of the speeds of the two motors driving the warp beam and the cloth beam of the loom respectively equalling the ratio of stretching desired for the bare elastomeric yarn.

It is also possible to combine beam supply for the secondary yarns with creel supply for the elastomeric yarns.

The fabric obtained from the loom is washed in conventional manner, for example in vat or with hot soapy water and, if required, subjected to a conventional dyeing, for example in an autoclave, or to bleaching and/or printing.

The thus obtained fabric is flat and has great elasticity and a pleasant handle.

The fact that the fabrics obtained are relatively flat means that there is no need for supplementary thermal treatment, which affords a substantial economic and energy saving and eliminates potential degradation of the yarn. Thus, the fabrics are more elastic, less hard and more resistant to wear and washing, so that a fabric so made can be lighter than previous fabrics offering the same properties, which again may reduce costs and the consumption of materials during treatment subsequent to wearing. Furthermore, since bare elastomeric yarns are being woven, which was in practice never possible until now, it is possible to use elastomeric yarns received directly from a spinning station, while the number of broken yarns and faults in the fabric is also reduced.

A lower tendency of the yarns in the fabrics to slip is observed with the invention, which means that the fabrics are less likely to fray during the operation of being cut for making up purposes.

With conventional weaving looms, wherein the weft is carried on a bobbin in the shuttle, it is possible to utilise for the weft an elastomeric yarn stretched to up to 400% and having a sheathing for instance of an elastic, bulked (e.g. crimped) textured yarn. On the other hand with rapier looms, the weft inserted can comprise an elastomeric yarn and another yarn, for example a textured false twisted yarn.

In practice, with such looms it is

desirable to feed the elastomeric weft yarn from a delivery roll.

As already stated, the process of the invention enables fabrics of a variety of weaves to be produced. The diversity of these fabrics can be enhanced by dyeing, for instance in the yarn, for instance in the secondary yarns. By suitable alternation of secondary yarns of different colours it is possible to obtain very varied effects superposed on the effects provided by the weave.

Fabrics made by the method of the invention can find numerous applications, such as in gloves, bathing costumes, brassieres, underwear, shirts, clothing, ribbons and furnishing material.

The invention will be more clearly understood from the following description which is given by way of example only with reference to the accompanying drawing in which the sole figure shows schematically a conventional weaving loom used for performing the invention.

The loom consists essentially of a beam 1 on which textured warp yarns 2 are wound under tension, a second beam 3 on which bare elastomeric yarns 4 are wound under light tension (for example stretched by 40%). These two beams are controlled by a common motor 5 at predetermined speed ratios with the aid of conventional sets of pinions and chains (for example the peripheral speed of the beam 1 is regulated to 9 times that of the beam 3 while the speed of beam 3 in relation to the cloth beam is such as to stretch the yarn by a factor of 4). If desired, one of the beams may be controlled, for example beam 3, and the other beam 1 simply braked by an appropriate device. The loom has two guide rollers 6 and 7 guiding the yarns and mounted for idling on their shafts, and a shedding mechanism 8 having eyelets 9 and 10 through each of which a yarn 2 and a yarn 4 passes. The healds are actuated to an alternating rise and fall movement in a known manner. A pair of parallel running yarns, that is one yarn 2 and one yarn 4, pass to each dent 12 in a reed 11 which is connected in known manner to a sley 13 which swings from right to left on a shaft 14. A rapier or a shuttle 15 for inserting weft into the shed 16 is provided and, the fabric 17 which is obtained is drawn off by a driving draw-off roll 18 to be wound up on a cloth beam 19. The two rolls 18 and 19 are controlled in synchronism by a motor 20 which in turn is connected in synchronism with the motor 5 (in certain cases the elements controlling motors 5, 20 and the elements controlling the movement of the healds 8 and the sley 13 are common elements).

Example 1

On a loom of Fatex (or Dornier) type as schematically shown in Figure 1 two beams of yarns wound under light or virtually no tension are mounted. One beam 3 comprises multi-filament in fact 6 filament, elastomeric yarns, 4, at 29 ends per centimetre and the yarns being of bare polyurethane 70 denier commercial brand Lycra (Registered Trade Mark) and without twist. The other beam, 1, comprises multifilament, in fact 26 filament yarns, 2, at 29 ends per centimetre, the yarns being of polyamide 6.6, 40 denier and textured (in fact crimped by false twist) and 'S' twisted at 300 turns/metre.

A polyurethane yarn 4 and a crimped yarn 2 is passed into each eyelet of the healds 8, whence they are jointly passed in parallel into each dent 12 of the reed 11.

By means of a set of weights applied to the beam 1 of the crimped yarns 2, these yarns are tensioned in their run to the fabric 17. By regulating the speed of the positive drive delivery roll of the beam 3 of bare elastomeric yarns 4 to one quarter of the drive speed of the beam 19 for fabric on the loom the bare elastomeric yarn is stretched about 400% at the reed 11.

With this warp is woven a composite weft yarn formed by one end of 70 denier/6 filaments polyurethane, twisted at 200 turns/metre and stretched to 400%, and one end of false-twisted textured, crimped, polyamide 6.6 of 40 denier without twist, the twist of the assembly being 'S' of 160 turns/metre.

The reed 11 contains two thousand dents 12 over a width of one hundred centimetres.

A taffeta fabric 17 with a count of 29 pairs of warp yarns and 29 weft yarns per centimetre is obtained, the fabric being transversely elastically shrunk relative to the position of the warps at the reed.

The fabric 17 at the fell is substantially flat, i.e. free from creping and blisters, and has a width of seventy centimetres and a weight of eighty grams/sq.m.

The fabric is then washed for one hundred and twenty five minutes in soapy water at 100°C and next dyed in an autoclave for one hundred and fifty minutes at one hundred degrees C.

The finished fabric has the following characteristics:—

width: fifty centimetres,
weight: one hundred grams per metre,
elasticity in warp } 50% to 60% in
elasticity in weft } both directions.

In this fabric the bare polyurethane yarns are tensioned and substantially straight, but are retracted relative to the state in which they are woven leading to contraction of the crimped warp yarns. This contraction is

substantially constant and uniform and imparts to the fabric an excellent hold and very good handle, so that it is perfectly suitable for the production of bathing costumes.

Example 2

In front of a loom for weaving ribbons there are positioned:—

a creel of Liba (Registered Trade Mark) type on which bobbins of tensioned bare elastomer yarn of 600 denier (Lycra, Registered Trade Mark brand) devoid of twist are unwound, and two beams. The first beam has as many two-ended folded yarns of cotton (Nm 20) as there are yarns from the creel and the second beam has four times as many two-ended folded yarns of cotton (Nm 20) as are on the first beam. (The metric count, Nm, is the length in metres of one gram of yarn).

Elastomeric yarns and cotton yarns from the first beam are passed in pairs to the same eyelets in a first group of two healds.

The four yarns of cotton issuing from the second beam are passed into eyelets on a second group of healds.

To every fifth dent of the reed of the ribbon weaving loom there are passed jointly and in parallel from one eyelet, an elastomeric yarn and a cotton yarn emanating from the first beam. To the other four dents of each five dents the four cotton yarns emanating from the second beam are passed.

The cotton yarns are maintained under tension and the elastomeric yarn is stretched by a factor of four in passing from the bobbins to the woven ribbon.

A two-ended folded yarn of cotton (Nm 20) is inserted into the warp so as to form a taffeta weaving with yarns shed by the first group of healds, while the shedding of the second group of healds is such that three of the cotton warp yarns are on one side, and one on the other side, of the weft, in each shed.

The yarn ends in both warp and weft is thirteen yarns per cm.

At the fell of the loom there is obtained a flat ribbon which after washing in hot soapy water and the usual finishing treatments (bleaching, dyeing, etc.) has an elasticity of 115% and is not slippery.

In this ribbon the elastomeric yarns are tensioned and rectilinear and the compression of the other warp yarns of cotton is constant and uniform. This ribbon is particularly suitable for manufacturing belts for slips, corsetry ribbons, garters and ribbons for gloves and brassieres.

WHAT WE CLAIM IS:—

1. A method of weaving an elastic fabric wherein there are employed, in the warp, pairs of yarns, each pair comprising a bare elastomeric yarn and another, secondary, yarn, the two yarns of each pair being under different tensions when woven and passing in parallel through the same heald eyelet to the same dent in the reed.

2. A method according to Claim 1 wherein the weft yarn is an elastic yarn as herein defined.

3. A method according to Claim 1 or 2 wherein the number of yarns per unit length is the same in the warp and weft directions.

4. A method according to Claim 1, 2 or 3 wherein the bare elastomeric yarn and the secondary yarn are supplied from respective beams, the beams being driven at different peripheral speeds, the ratio of the speeds being equal to the ratio of the tensions of those yarns.

5. A method according to any preceding claim wherein the fabric is finished with a conventional washing treatment and a dyeing or printing treatment.

6. A method of weaving an elastic fabric substantially as hereinbefore described with reference to the accompanying drawing.

7. An elastic fabric made by the method of any preceding claim.

8. A fabric according to Claim 7 wherein the elastomeric yarn is an elasthane, polyurethane or elastodiene yarn.

9. A fabric according to Claim 7 or 8 wherein the secondary yarn is a spun yarn or multi-filamentary yarn.

10. A fabric according to Claim 9 wherein the secondary yarn is an elastic, textured, multi-filamentary yarn.

11. An elastic fabric according to Claim 7 and substantially as described herein.

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